COMPLETE LIST OF CLAIMS AS AMENDED

2. A musical instrument preamplifier system comprising:

a filtering means for splitting an input signal into two or more separate frequency bands comprising a similar phase response for each frequency band;

two or more non-linear circuits, each of which distorts the input signal component of one of the frequency bands; and

a summing network for recombining said frequency bands;

wherein said filtering means comprises a cascade of 2^N - 1 pairs of even poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade, and wherein for the nth stage subsequent to the first, each low or high pass filter pair is preceded by $(2^{n-1} - 1)$ all pass filters with phase response corresponding to the $(2^{n-1} - 1)$ other low and high pass filter phase response in that stage such that the phase response of each stage is similar for each frequency band.

3. A musical instrument preamplifier system according to claim 2 wherein said cascade has two stages of two pole low and high pass filter pairs.

5. A musical instrument preamplifier system according to claim 2 wherein each low and high pass filter pair is a state variable filter.

7. A musical instrument preamplifier system according to claim 5 wherein the filtering means further comprises variable cross-mixing after one or more stages of said filtering means.

9. A musical instrument preamplifier system comprising:

a filtering means for splitting an input signal into two or more separate frequency bands comprising a similar phase response for each frequency band;

two or more non-linear circuits, each of which distorts the input signal component of one of the frequency bands; and

a summing network for recombining said frequency bands;

wherein the filtering means further comprises variable cross-mixing after one or more stages of said filtering means; and

further comprising low pass filtering means after said non-linear circuits to reduce high frequency distortion products;

wherein said low pass filtering means is combined with said summing network such that in successive stages the lowest frequency band is low pass filtered with a low pass filter and the other frequency bands are all pass filtered with an all pass filter corresponding to said low pass filter, said lowest frequency band is then combined with the next lowest frequency band, and comprising subsequent stages of repeated filtering and combining until all frequency bands are combined, such that the phase response over all frequency bands through the low pass filtering and summing network is identical.

13. A guitar preamplifier comprising:

a filtering means for splitting an input signal into a multiple number of separate frequency bands, comprising a cascade of $2^N - 1$ pairs of even poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade, each low and high pass filter pair forming a state variable filter, and in each nth stage subsequent to the first, each low or high pass filter pair is preceded by $(2^{n-1} - 1)$ all pass filters having phase responses of the $(2^{n-1} - 1)$ low or high pass filter pairs in the other channels such that the phase response of each stage is similar for each frequency band, and said filtering means further comprising variable cross-mixing after one or more of said stages of filtering,

a multiple number of non-linear circuits, each arranged to distort the input signal component of one of the frequency bands; and

a summing network for recombining said frequency bands including low pass filtering means arranged such that in successive stages the lowest frequency band is low pass filtered with a low pass filter and the other frequency bands are all pass filtered with an all pass filter corresponding to said low pass filter, said lowest frequency band is then combined with the next lowest frequency band and subsequent stages of repeated filtering

and combining until all frequency bands are combined, such that the phase response over all frequency bands through the low pass filtering and summing network is identical.

15. A digital musical instrument preamplifier system comprising:

a digital filtering means for splitting an input sampled signal into two or more separate frequency bands comprising a similar phase response for each frequency band;

two or more non-linear digital circuits, each of which distorts the input signal component of one of the frequency bands; and

a digital summing network for recombining said frequency bands;

wherein said digital filtering means comprises a cascade of $2^N - 1$ pairs of even poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade, and wherein for the nth stage subsequent to the first, each low or high pass digital filter pair is preceded by $(2^{n-1} - 1)$ all pass digital filters with phase response corresponding to the $(2^{n-1} - 1)$ other low and high pass digital filter phase response in that stage such that the phase response of each stage is similar for each frequency band.

16. A digital musical instrument preamplifier system according to claim 15 wherein each digital low pass and high pass filter is obtained by a bilinear transformation of a corresponding low pass and high pass analogue filter, and the all pass filters are obtained by a bilinear transformation of a corresponding all pass analogue filter.

19. A digital musical instrument preamplifier system comprising:

a digital filtering means for splitting an input sampled signal into two or more separate frequency bands comprising a similar phase response for each frequency band;

two or more non-linear digital circuits, each of which distorts the input signal component of one of the frequency bands; and

a digital summing network for recombining said frequency bands;

wherein the digital filtering means further comprises variable digital cross-mixing after one or more stages of said digital filtering means; and

further comprising digital low pass filtering means after said digital non-linear circuits to reduce high frequency distortion products.

20. A digital musical instrument preamplifier system according to claim 19 wherein said digital low pass filtering means is combined with said summing network such that in successive stages the lowest frequency band is low pass filtered with a digital low pass filter and the other frequency bands are all-pass filtered with a digital all-pass filter corresponding to said low-pass filter, said lowest frequency band is then combined with the next lowest frequency band, and comprising subsequent stages of repeated digital filtering and combining until all frequency bands are combined, such that the phase response over all frequency bands through the digital low pass filtering and summing network is identical.

21. A musical instrument preamplifier system comprising:

a filtering means for splitting an input signal into two or more separate frequency bands comprising a substantially equi-phase response for each frequency band;

two or more non-linear circuits, each of which distorts one of the frequency bands; and

a summing network for recombining said frequency bands.

22. A musical instrument preamplifier according to claim 21, wherein said filtering means comprises a cascade of 2^N - 1 pairs of even-poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade, and wherein for the nth stage subsequent to the first, each low or high pass filter pair is preceded by $(2^{n-1} - 1)$ all pass filters with phase response corresponding to the $(2^{n-1} - 1)$ other low and high pass filter phase response in that stage such that the phase response of each stage is similar for each frequency band.

23. A musical instrument preamplifier system according to claim 22 wherein said cascade has two stages of two pole low and high pass filter pairs.

24. A musical instrument preamplifier system according to claim 21 wherein each low and high pass filter pair is a state variable filter.

25. A musical instrument preamplifier system according to claim 22 wherein each low and high pass filter pair is a state variable filter.

26. A musical instrument preamplifier system according to claim 21 wherein the filtering means further comprises variable cross-mixing after one or more stages of said filtering means.

27. A musical instrument preamplifier system according to claim 26 wherein the filtering means further comprises variable cross-mixing after one or more stages of said filtering means.

28. A musical instrument preamplifier system according to claim 26 further comprising low pass filtering means after said non-linear circuits to reduce high frequency distortion products.

29. A musical instrument preamplifier system according to claim 28 wherein said low pass filtering means is combined with said summing network such that in successive stages the lowest frequency band is low pass filtered with a low pass filter and the other frequency bands are all pass filtered with an all pass filter corresponding to said low pass filter, said lowest frequency band is then combined with the next lowest frequency band, and comprising subsequent stages of repeated filtering and combining until all frequency bands are combined, such that the phase response over all frequency bands through the low pass filtering and summing network is identical.

30. A musical instrument preamplifier system according to claim 21 wherein said non-linear circuit for each frequency band has a different gain than those in the other frequency bands.

31. A musical instrument preamplifier system according to claim 21 wherein said non-linear circuits for higher frequency bands have a higher minimum gain than the non-linear circuits for lower frequency bands.

32. A musical instrument preamplifier system according to claim 21 wherein the distortion by said non-linear circuits is variable.

33. A digital musical instrument preamplifier comprising:

a digital filtering means for splitting an input sampled signal into two or more separate output frequency bands comprising a substantially equi-phase response for each frequency band;

two or more non-linear digital circuits, each of which distorts one of the output frequency bands; and

a digital summing network for recombining said frequency bands.

34. A digital musical instrument preamplifier according to claim 33, wherein said digital filtering means comprises a cascade of 2^N - 1 pairs of even poled low and high pass filters arranged such that each pair splits the incoming frequency band in two, where N is the number of stages of pairs in the cascade, and wherein for the nth stage subsequent to the first, each low or high pass digital filter pair is preceded by $(2^{n-1} - 1)$ all pass digital filters with phase response corresponding to the $(2^{n-1} - 1)$ other low and high pass digital filter phase response in that stage such that the phase response of each stage is similar for each frequency band.

35. A digital musical instrument preamplifier according to claim 34 wherein each digital low pass and high pass filter is obtained by a bilinear transformation of a corresponding low pass and high pass analogue filter, and the all pass filters are obtained by a bilinear transformation of a corresponding all pass analogue filter.

36. A digital musical instrument preamplifier according to claim 33 wherein said digital filtering means comprises linear phase finite impulse response filters.

37. A digital musical instrument preamplifier according to claim 33 wherein said digital filtering means further comprises variable digital cross-mixing after one or more stages of said digital filtering means.

38. A digital musical instrument preamplifier according to claim 37 further comprising digital low pass filtering means after said digital non-linear circuits to reduce high frequency distortion products.

39. A digital musical instrument preamplifier according to claim 38 wherein said digital low pass filtering means is combined with said summing network such that in successive stages the lowest frequency band is low pass filtered with a digital low pass filter and the other frequency bands are all-pass filtered with a digital all-pass filter corresponding to said digital low-pass filter, said lowest frequency band is then combined with the next lowest frequency band, and comprising subsequent stages of repeated digital filtering and combining until all frequency bands are combined, such that the phase response over all frequency bands through the digital low pass filtering and summing network is identical.

40. A musical instrument preamplifier comprising:

a) a filtering means with a first filter network, the network including:

an input,

a plurality of outputs, and

a plurality of band splitter filters to split a signal on the input into a plurality of substantially equi-phase frequency bands for the outputs;

and

b) a plurality of non-linear circuits coupled to a plurality of the outputs to distort respective output frequency bands.

41. A musical instrument preamplifier system comprising:

a filtering means for splitting an input signal into plurality of substantially equi-phase frequency band outputs, and

a plurality of non-linear circuits coupled to filter means to distort respective output frequency bands,

wherein the filtering means includes a cascade of a first filter network, and one or more subsequent filter networks, each network including:

an input,

a plurality of outputs, and

a plurality of band splitter filters to split a signal on the input into a plurality of frequency bands for the outputs,

wherein for one or more of the subsequent networks, the input of each is coupled to one output of another network via a filter to provide substantially equi-phase frequency bands on the network's outputs,

and wherein outputs of some of the networks form frequency band outputs of the filter means.